INDIANA CHALK BEDS.

At numerous points in Northern Indiana the Drift deposits contain "marl" or chalk formations of a very interesting nature. The substance is of a grayish or creamy-white color and consists chiefly of carbonate of lime. When burned it furnishes a very fair quick-lime, but not the best. It is found in a variety of situations, usually, however, in such a relation to other calcareous deposits, that it could result either from the disintegration of limestones (or from the "leeching" of a Drift formation, containing lime pebbles and finely comminuted limestone) or from the evaporation of fresh water charged with lime and magnesia. Usually, this chalk, commonly called marl, is found in low, marshy places, or around the border of small lakes. I have observed it in stages of condition, varying from a slightly calcareous silicate of alumina to a nearly pure carbonate of lime. At some places the thickness of the purer beds has been reported at as much as thirty-five feet by well-diggers. Many of the beautiful little lakes in our northern area are rimmed with a deposit of this chalk, though in some instances, as at Maxinkuckee, it is nearer a kaolin than a chalk, owing to the presence of silica and alumina far in excess of the lime. Very often there is found a deposit, more or less thick, of a peaty nature overlying the chalk, showing that a vegetable growth has for years covered the area. Indeed, these areas of chalk deposit are invariably surrounded by a higher deposit of Drift material, and are, therefore, basins into which, for a long period of time, the water has percolated through the body of this more elevated material. Now, rain water in passing through calcareous Drift deposits would take up the lime in two ways: First, by solution; second, by lifting in suspension infinitessimal particles of mechanically divided carbonate of lime from the limestones ground up by glacial action. This finely powdered limestone forms a considerable part of the Drift clays and sands, and is an element of our so-called lime tufas, which so rapidly form in certain spouty and springy places. Our Drift mass also contains a large proportion of finely powdered quartz, hornblende, feldspar and other silicates, besides iron in various forms, notably pyrites. The gradual destruction of these substances by rainwater filtering through the Drift mass and bearing the solution into the adjacent basins has resulted in the deposition of this chalk, which upon analysis shows that it is constituted as follows:

Water and carbonic acid	50.06
Insoluble silicates	0 30
Oxide of iron	0.10
Alumina	1.40
Lime	45.38
Magnesia	2.00
Sulphuric acid	0.40
Phosphoric acid	0.38
	100.00

Professor Cox made some analyses showing but a slight variation from the above. In each case the chalk was taken from the purest deposits obtainable. In most cases the oxide of iron is but a doubtful trace, the color indicating its presence disappearing under heat. No doubt the silica and the alumina in the substance is mostly in the free form, while the lime and magnesia have been for the most part chemically precipitated. The iron and sulphuric acid have come from the destruction of iron pyrites. This chalk is not similar to that of the older rocks. Under the microscope it shows no foraminifera or other organic forms. It appears chiefly a flour-like substance with an intermixture of extremely fine grains of free silica, lime and magnesia. As I have said, it varies, through many stages, from a kaolin-like clay-marl, as at Maxinkuckee, to a condition of almost pure carbonate of lime. The following is an analysis of the deposit at Maxinkuckee, made by Dr. Hurty:

Silica	53.20
Calcium carbonate	12.67
Magnesium carbonate	3.03
Alumina	26.76
Ferric oxide	4.24
Total	99.90

The great difference in the constituent parts observable in comparing these extremes is due to the Drift mass from which the water has derived its load of suspended or dissolved matter. The silica of the Maxinkuckee clay is largely free, while its lime is a precipitate. But here the silica and alumina greatly overbalance the lime because the Drift mass from which the matter has been selected was silicious and aluminous to a greater degree than it was calcareous. The chalk deposits found around the margins of many of our lakes have resulted largely from evaporation of water heavily charged with lime; but the precipitation is also due, in part, as Prof. Cox has suggested, to the "agency of the atmosphere and aquatic plants." A homely illustration would be the incrustation of the bottom and sides of a tea-kettle with lime by boiling "hard" water in it. But the origin of the elements constituting the chalk, so far as their presence in the water would be concerned, must be looked for in the surrounding Drift mass.

In Kosciusko County, on the farm of Charles Fribly, has been discovered a deposit of a kaolin-like clay very similar to that at Maxinkuckee,

but in great quantities. It is in the midst of a marshy tract of land across which a water-current has flowed some time in the past. The deposit is evidently the result of selection by the water, as it is found in juxtaposition to two grades of fine sand. The following is Dr. Hurty's analysis of a sample of this Kosciusko County clay:

Silica	43.10
Ferric oxide	4.77
Alumina	20.78
Calcium carbonate	20.51
Magnesium	10.80
Total	99.96

All of our lakes are mere cups or basins in the Drift till, or bowlder clay. Many of them are fed by springs flowing out of the Drift mass around their margins or bubbling up from their bottoms. The water of these springs is more or less charged with salts of iron and with lime, magnesia, etc., derived from the material through which it flows. Now, most of these lakes have very feeble if any outlets, and constant evaporation going on must result in the precipitation of the mineral matter held in solution. In most cases the lakes are fringed with a thick growth of aquatic plants and in some instances the deposition of peaty matter is going on rapidly. Indeed, a number of very interesting covered or "blind" lakes exist, where floating vegetable matter has formed a coat of soil over the water's surface upon which trees and other plants are now growing. This encroachment of vegetation upon the domain of the water has gradually lessened the area of the lakes, a process greatly aided by the chalk formation going on at the same time, and in the course of time, all the beautiful bodies of water now existing in our northern area will be totally destroyed.

The survey so far has just reached these lakes, and the study of the chalk deposits has not proceeded far enough for any thorongh report to be made upon them; but enough is known for it to be confidently said that they are of great value, and promise a rich return in the future when they shall be worked for the making of fertilizers. In my next report I hope to give this subject thorough investigation.

The following is the analysis by Dr. Hurty of the fine "sand" over lying the clay, analysis of which is above given:

Silica	45.35
Ferrie oxide	3.10
Alumina	25.62
Calcium carbonate	17.95
Magnesium carbonate	7.98
Total	100.00

This would show that the "sand" and the clay are practically identical, one being a mere selection from the other by the action of water.